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IMPROVING CREATIVITY OF THE FUTURE PHYSICS TEACHERS THROUGH GENERAL BIOLOGY LEARNING BASED ON CTL WITH EXPERIMENTAL METHOD

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ABSTRACT

The purpose of this research was to increase the creativity of the future physics teachers through General Biology learning based on CTL with experimental method. The type of research used in this study was classroom action research (CAR) through 4cycles of activity. Cycle I shown that on the achievement of creativity, the lowest indicator was in formulating the question (59.21%), and the highest indicator was in formulating conclusion (76.32%) while the average of indicators' achievement was 71,71% in which the target of 75% of performance indicator were failed to reach.Cycle II shownthat the lowest achievement indicator wasin applying the principle, that is 63,16% and the highest achievement indicator is in formulating the conclusion, that is 78,95% while the average achievement of critical thinking skill of cycle II equal to 71,21%. Physics future teachers creativity were improved to 8.55% from pre-cycle I to cycle I while from cycle I to cycle II improved to 6.14%. The result of cognitive learning shown that of the cycle II was obtained the mean value of cycle II which equal to 76.82. The percentage of the learners who had reached the target of learning mastery was 77.14%. The average of cognitive learning achievement of Physics future teachers was improved from pre-cycle to cycle I into 10.54 while from cycle I to cycle II was improved to 3.2. The results show that CTL experimental method can improve the creativity of the future physics teacher of IAIN Palangka.

Keywords: CTL, creativity, experimental method

INTRODUCTION

Sabila (2013) states that creativity is very important in life, because in human life, creativity is merely needed. Creativity will grow when the learners are having motivation, curiosity, and high imagination which will end up with creative results. In addition to developing intelligence, creativity also needs to be nurtured, developed and improved. Through creativity, learners can stimulatetalents and abilities, solve their problem and improve the quality of life in the future.

Mynbayeva, et al. 2016 states that one of the main challenges of modern higher education is the development of learners' creativity. The diagnosis of creativity and the mental processes associates and the development of creativityis very essential. While Soh (2017) states that fostering the creativity of learners has become an extra responsibility of being educators. Therefore educators need to be aware of possible ways to foster the creativity of learners. Creativity of the learners can be enhanced through social modeling, reinforcement, and classroom atmosphere. It is said that the teaching behavior of educators plays an important role in encouraging the creativity of learners.Similarly, Jonsdottir (2017) states that modern society prioritizes creative thinking and capacity to actualize ideas. Fostering creativity turns out to be a

complex enterprise, characterized by several factors that can be adjusted and influenced.

Sawyer (2017) states that teaching creativity is increasingly important for educators to help learners develop as creative individuals, and prepare graduates for creative thinking in the workplace, personal life, andsociety. Many countries are working and providing schools as a place to produce creative learning outcomes. However, very little is known about how to teach creativity. Deta, et al. (2013) states that there is an interaction among learning methods, creativity, and science process skills to cognitive and affective learning achievements. Wood & Ashfield (2008) states that for education in the UK, the creativity of learners needs to be improved through the learning process. Increased creativity of the learners is not separated from the high creativity of educators in applying the method of learning. The description strengthens the importance of creativity of future teachers of science, as well as the subject of students in General Biology and as a future teacher.

The result of evaluation and observation shows that the result of general Biology learning of the second semester teacher candidate of Physics Education Department has not reached the set target. The results of observation on creativity were concluded by observing 6 indicators, namely (1) formulating questions, (2) formulating hypotheses, (3) designing experiments, (4) determining variables, (5) interpreting data and (6) formulating conclusions. The result has shownthe average achievement of creativity in pre-cycles activity is 65.35%. The prospective teachers' cognitive learning outcomes are still low. The results of the midle-term test of prospective teachers in the subjects of General Biology shows that56.80% of the 19 prospective teachers get a score of less than 70. The low cognitive learning outcomes has shown that the mastery of general biology concept of prospective teachers is still low.

The prospective teacher's creativity needs to be improved. General Biology course subjects should ideally cultivate creativity. Based on the description, it is necessary to conduct classroom action research of General Biology Learning based on Contextual Teaching and Learning (CTL) with experimental method to improve the creativity of prospective teachers of PMIPA Faculty of Tarbiyah and IAIN of Palangkaraya. This research is considered important to improve the competence of teachers of science in the future, both in understanding the concepts of biology and affective competence. The results of this study are expected to be a reference in learning, especially for Biology subjects in General.

METHOD

The type this research is classified into classroom action research or CAR (Arikunto, 2007). The research design used is CAR spiral system with Hopkins model as in Figure 1.

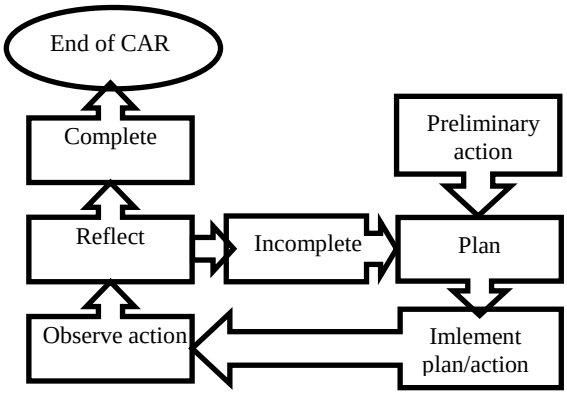

Figure 1. The design of Hopkins Model Adaptation

This research was conducted in accordance with the Hopkins model research design that begins with preliminary action and then proceeds with planning, action, observation, and reflection. The Research done insequences or cycles until the research objectives are achieved. If the results of the evaluation in cycle I is still incomplete, the improvement will be done in cycle II. Reflection cycle I was done to determine the improvement steps in cycle II, and so on until the research objectives are achieved. Data collection techniques

used in this study are observation, tests, and field notes.

Performance indicators are a criterion used to see the success rate of CAR activities in improving or revising the teaching and learning process in the classroom (Kunandar, 2008). The measured indicator in this research is the improvement of prospective teachers' rate of creativity after the action of General Biology learning through CTL with experimental method, at least 75% completed into creative chategory.

RESULT AND DISCUSSION

Cycle I was held in one meeting. The material studied in cycle I is the introduction of invertebrate and vertebrate animals. Achievement of cognitive learning in cycle I obtained from the test with the average value of cognitive learning results of cycle I of 70.47 with the highest score of 85.75 and the lowest of 52.75. The percentage of the number of prospective teachers who reached the learning completeness limit is 73.68% so that the cognitive learning results of cycle I have not reached the indicator of classical performance that is set at 75%. The achievement of the cycle I cycle creativity is presented in Table 1.

Table 1. Achievement of cycle I indicator

No.	Indicator	Achievement (%)
1	formulating questions	59,21
2	formulating hypothesis	72,37
3	experiment-planning	75,00
4	finding variabel	72,37
5	interpreting data	75,00
6	formulating conclusion	76,32
Average		**71,71**

In Table 1, the achievement indicator with the lowest score is in formulating questions 59.21 and the highest is in formulating conclusion 76.32. The average of cycle I Is 71.71 thus the target of performance indicator was failed to be reach.

The material discussed in cycle II is the monohydro and hybrid crossover. Learning outcomes achieved in the learning activity cycle II is the achievement of cognitive aspect learning achievement of the second cycle the prospective teachers obtained from the written test with the average value of cognitive learning outcomes cycle II of 76.82 with the highest value of 88.48 and the lowest score of 57.14. The percentage of the number of learners who have reached the limit of learning mastery is 77.14%. From the data can be concluded that the cognitive learning result of cycle II has reached the classical completeness. The achievement of the indicator of creativity cycle II is presented in Table 2.

Table 2. Achievement of cycle II indicator

No.	Indicator	Achievement (%)
1	formulating questions	75,00
2	formulating hypothesis	78,95
3	experiment planning	77,63
4	finding variable	73,63
5	data interpreting	78,95
6	formulating conclusion	82,89
Average		**77,85**

The data in Table 3 indicates that the lowest indicator achievement is in finding the variable of 73.63%, while the highest indicator is in formulating the conclusion of 82.89%. The average achievement of creativity cycle II is 77.85% thus it has reached the performance's indicator.

Comparison of affective creativity learning outcomes in pre cycle, cycle I, and cycle II shown different scores. The result of comparison of between cycles is shown in Figure 2.

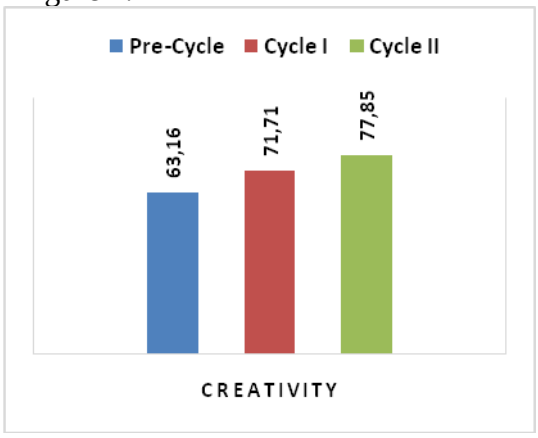

Figure 2. Creativity comparison of pre-cycle, cycle I and cycle II

Figure 2 shows the increase of teacher candidate creativity from pre cycle to cycle I of 8,55% and from cycle I to cycle II equal to 6,14%, while the prospective teachers' critical thinking skill increased from pre cycle to cycle I equal to 6,8 % and from cycle I to cycle II increasedinto 8.12%.

The result of cognitive learning in Figure 3.

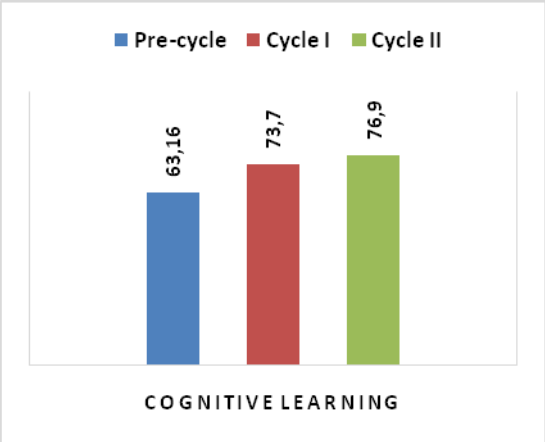

Figure 3. The comparison of cognitive learning cycles

Figure 3 shows an increase in cognitive learning outcomes of prospective teachers from pre cycle to cycle I of 10.54 and from cycle I to cycle II of 3.2.

The first cycle of learning activities, organizing classes into large groups were inhibited the critical rhinking skill to grow. This is because the active participation of prospective teachers in the learning process was also inhibited. The assignment of group scientific writing project has not been able to maximize the potential of individual prospective teacher in connecting the concept of biology into the real life context.

Learning process in cycle II was designed based on the improvement of the findings and recommendations in cycle I. At the stage of filing the problem in cycle II each group observed the gene model object. Each of prospective teacher observes and reads the description contained on the worksheet and then discusses in group to formulate the problem and the hypothesis. At this stage the group discussions are going well. In the second phase of problem solving cycle, the ability of prospective teachers in designing experiments has increased significantly because a few days before conducting the experimental activity, prospective teachers are required to read the basic theory about the experiment to be performed. Most of the prospective teachers have been able to formulate experimental principles, mention the variables measured, assemble the tools, and make measurements. At this stage most of the prospective teachers are already active in their group activities. Discussion of prospective teachers runs well. Almost all prospective teachers are already involved in assembling tools and materials and making measurements.

The division of groups into smaller ones is quite effective in enabling prospective teachers. Within a smaller group each prospective teacher feels responsible for the group's activities. In addition, individual guidance can be done more so as to better understand the internal condition of prospective teachers. The collection of data and conclusions taken by each group is based purely on observations. All prospective teachers actively work with their groups, either experimenting or discussing to fill out worksheets. No prospective teacher is pacing around looking at the work of other groups or flipping through books to equate the theory with the data collected. This shows the prospective teacher's awareness of the importance of the process during the experiment compared to the results of the experiments obtained.

Improvements that have been made in cycle II was able to improve the quality of learning implementation. Improving the quality of learning implementation has an impact on improving teacher learning outcomes. This can be seen from the improvement of cognitive achievement test result from pre-cycle up to cycle II. The improvements made in cycle II, especially in terms of division of the group into smaller and individual assignment model to impact the increase in affective learning outcomes of prospective teachers. Learning

patterns that link biological materials to real-world contexts can foster the prospective teacher's curiosity. Group learning with small group strategies can improve teacher candidate cooperation. Each prospective teacher has a sense of responsibility and feels an important part of the group. The application of the experimental method gives effect to the enhancement of prospective teachers' creativity. Prospective teachers are trained to perform the stages of concept discovery in accordance with the stages of scientific methodand the level of critical thinking skills. The assignment in making individual reports is also effective in fostering the critical thinking skills of prospective teachers. With the improvement of treatment in cycle II, the critical thinking skills of prospective teachers have been increased.

Johnson (2002) states that CTL steps that can be used in critical and creative thinking. Contextual learning system is about intellectual achievement that comes from active participation to experience meaningful experiences. Stages of CTL learning activities with experimental methods are designed to foster the creativity of prospective teachers. The biology concept studied is related to the context of everyday life, the use of experimental methods is a means to develop the creativity of prospective teachers. Experiments can motivate prospective teachers to examine a particular problem that is being studied in depth and prospective teachers are free to explore diverse perspectives.

The results of this study indicate that creativity can be improved through learning. This is consistent with Gardiner's (2017) research that teachers need to facilitate and provide flexibility to learners in the learning process to develop the creativity of learners. Munandar (2004) states that creativity is the result of individual interaction and environment. A person influences and is influenced by the environment in which he/she is located, thus changes in the individual and environment can support or hamper creative efforts. The implication is that creative ability can be improved through education. In line with Kim & Cho (2016) research results stated that to enhance creativity, integrated instruction should include processes in which learners understand and can solve open and complex problems related to real life.

Presenting a creative context in which learners can work with real-life examples and future problems can help develop integrated and creative thinking. To develop creative and convergent thinking, an instructional plan that enables effective group work should be provided to analyze the cooperative learning process for gifted learners. The creative potential of gifted learners can be enhanced by increasing creativity in groups to apply integrated instruction that not only enhances creativity but also creative personality.

Learning with CTL experimental methods can improve the prospective teachers' creativity. This is in accordance with the results of Yuwanawati's research (2014: 18-24), namely that learning CTL can improve creativity and have a significant influence on cognitive learning outcomes. This happens because prospective teachers can pay attention and follow the learning process well. Prospective teachers are also active to ask if there is something that is not clear when the lab and discussion. Prospective teachers tend to be active and compact while working in groups. Prospective teachers can also appreciate and actively respond positively when other groups present their work. The result of cognitive learning of prospective teachers is increasing because in CTL experimental method, the lecturer explains the material that is integrated with the daily life experienced by prospective teachers, so that the teacher candidate can more easily understand and know the benefits or application of material that has been delivered. This makes it easier for teachers to understand the material so as to obtain better cognitive learning outcomes.

Implementation of CTL can foster the creativity of prospective teachers, because

CTL facilitates the involvement of prospective teachers in full to be able to find the material learned and connect it with real life, so that prospective teachers can implement it in everyday life. Prospective teachers feel the importance of learning through the process of applying competence in everyday life, and they will deeply interpret what they learn. CTL is done naturally, enabling a quiet and enjoyable learning process, so that prospective teachers can practice directly the things they learn. Contextual learning encourages prospective teachers to understand the nature of meaning, and the benefits of learning. This allows them to be diligent, and motivated to constantly learn. This condition manifests, when prospective teachers realize what they need to live, and how to achieve it.

CTL is a comprehensive system. CTL consists of parts that are integrated. If these parts are intertwined with one another, an effect will be more than the result of the parts given separately. The application of CTL has advantages, namely: (1) CTL emphasizes the process of involvement of prospective teachers to find the material, meaning the process of learning is oriented directly to the experience process, (2) the learning process in the context of CTL does not expect prospective teachers to receive only lessons, (3) CTL encourages prospective teachers to discover the relationship between the material learned and the real-world situation, meaning that the prospective teacher is required to capture the relationship between the school's learning experience and real life. This is very important, because by being able to correlate the material found with real life, not only for the prospective material teacher who is found with real life, not only for the prospective teacher the material will be functionally meaningful, but the material he or she studies will be embedded in memory (4) CTL encourages prospective teachers to apply it in life, meaning CTL is not only expecting the teacher to be able to understand the material it's learning, but how the subject matter can color its behavior in everyday life. The subject matter in CTL context is not to be stacked in the box and then forgotten, but as their provision in real life.

CTL is a learning system that suits the performance of the brain, to develop patterns that embody meaning, by linking academic content to the context of everyday life of prospective teachers. This is important so that the information received is not only stored in short-term memory, but can be stored in long-term memory so that it will be appreciated and applied in the job task. CTL is a learning concept whereby educators bring the real world into the learning process and encourage prospective teachers to make connections between their knowledge and application in their everyday lives, while prospective teachers gain knowledge and skills from a limited context, bit by bit, and from process, self-construct, as a provision to solve problems in his life as a member of society. Contextual learning is a teaching that enables prospective teachers to strengthen, extend, and apply their academic knowledge and skills in order to solve real-world problems or simulated problems. Contextual learning occurs when prospective teachers apply and experience what is being taught by referring to real-world issues related to their roles and responsibilities as family members, citizens, prospective teachers and the workforce.

Johnson (2010) argues that the linkage that leads to this meaning is central to the application of contextual learning. But in search of this meaning, need to pass various stages of learning process. Prospective teachers need to experience a gradual learning will lead them to understand the true meaning of what he learned. Here is the fundamental role of a contextual approach. With appropriate model submissions, through questioning and probing processes, prospective teachers are conditioned to construct their own understanding of what they learn. Prospective teachers will get used to looking for the meaning behind the existing problems. Then prospective teachers will be guided to reflect on each

part by learning sections, and also reflect on the end of a learning process. This is where an actual assessment can be made, an assessment that involves the entire process of learning.

CONCLUSION

The conclusion of this research is that learning of General Biology with CTL model through experimental method can increase creativity from pre cycle to cycle I and from cycle I to cycle II. This learning can also improve cognitive learning outcomes until classical graduation is achieved. With these results, then learning by CTL model through experimental method can be recommended as an alternative in the application of learning, both in college and in school.

REFERENCES

Deta, U. A., & Widha, S. (2013). The Influence of Guided Inquiry Methods and Projects, Creativity, and Science Process Skills to Student Achievement. *Jurnal Pendidikan Fisika Indonesia*, *9*(1):28-34.

Jonsdottir, S.R. (2017). Narratives of creativity: How eight teachers on four school levels integrate creativity into teaching and learning. *Thinking Skills and Creativity*, 24(1): 127-139.

Johnson, E. B. (2010). *Contextual Teaching & Learning:* Make Learning-Teaching Fun and Meaningful. Bandung: Kaifa.

Kim, M. K., Roh, I. S., & Cho, M. K. (2016). Creativity of gifted students in an integrated math-science instruction. *Thinking Skills and Creativity*, *19*, 38-48.

Kunandar. (2008). Easy Step Classroom Action Research as Teacher Profession Development. Jakarta: Raja Grafindo Persada.

Munandar, U. (2004). Development of the Creativity of the Children. Jakarta: Rineka Cipta.

Gardiner, P. (2017). Rethinking feedback: Playwriting pedagogy as teaching and learning for creativity. *Teaching and Teacher Education, 65*, 117-126.

Sawyer, R. K. (2017). Teaching creativity in art and design studio classes: A systematic literature review. *Educational Research Review*, *22*, 99-113.

Soh, K. (2017). Fostering student creativity through teacher behaviors. *Thinking Skills and Creativity, 23*, 58-66.

Yuwanawati, R. (2014). Mathematics learning using contextual teaching and learning method (ctl) and problem based learning (pbl) on cube and block subjects in terms of creativity of students of class viii smp muhammadiyah 5 ngawi even semester of lesson year 2013. *JANGKA*, *1*(1).